

## **PROVEN TECHNOLOGY THAT WORKS**

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### **UXO Remediation, Treatment, and Disposal**

#### **ABSTRACT**

The U. S. Army Aberdeen Test Center (ATC) and the U. S. Army Technical Escort Unit (TEU) were jointly tasked to remove and dispose of munitions and munitions related items (MMRI) located along the shoreline of and/in the Chesapeake Bay section of the Aberdeen Proving Ground (APG).

Weapon development and testing is one of APG missions which has required firing millions of rounds on various APG ranges since 1918. Before Army regulations changed, the installation performed periodic sweeps on its ranges to collect MMRI on the surface and dispose of them in pits. Decades of soil erosion have exposed seven pits and non-recovered munitions along the shoreline and off-shore in shallow water at Abbey Point. The two concerns associated with the MMRI exposure are environmental and safety hazards. While very little is known about the environmental effects on the Chesapeake Bay from decaying munitions, the exposed MMRI pose a potential physical hazard to people and animals, thus safety is the major concern.

This paper focuses on the removal action recently completed at shoreline pile number one and future removal actions to be taken to complete the removal of the remaining six (6) piles along the shoreline and shallow waters in the Chesapeake Bay around Abbey Point.

#### **INTRODUCTION**

Aberdeen Proving Ground is a 72,000 acre Army installation located in southern Harford County and southeastern Baltimore County, Maryland on the western shore of the Upper Chesapeake Bay (Figure 1).

Weapon development and testing is one of Aberdeen Proving Ground missions which has required firing millions of rounds on various Aberdeen Proving Ground ranges since 1918. Before Army regulations changed, the installation performed periodic sweeps on its ranges to munitions and munitions related items (MMRI) on the surface and dispose of them in pits. Decades of soil erosion have exposed seven pits and non-recovered munitions along the shoreline and off-shore in shallow water at Abbey Point field in a restricted section of the installation (Figure 1).

The two concerns associated with the MMRI exposure are environmental and safety hazards. While very little is known about the environmental effects on the Chesapeake Bay from decaying munitions, the exposed MMRI posed a potential physical hazard to people and animals, thus safety is the major concern. A wide variety of physical security counter-measures are employed to preclude unauthorized entry to this area. Despite these security measures, trespassing is a concern.

This paper focuses on the magnitude of the removal action recently completed at Abbey Point Shoreline Pile Number One, regulatory requirements, work site operations/actions, results, conclusions, and future removal actions to be taken to complete the removal of the remaining six (6) piles along the shoreline and shallow waters of the Chesapeake Bay around Abbey Point field.

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE <b>AUG 1998</b>		2. REPORT TYPE		3. DATES COVERED <b>00-00-1998 to 00-00-1998</b>	
4. TITLE AND SUBTITLE <b>Proven Technology That Works</b>				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>U. S. Army Aberdeen Test Center,Attn: STEAC-FC,Aberdeen Proving Ground,MD,21005-5059</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>					
13. SUPPLEMENTARY NOTES <b>See also ADM001002. Proceedings of the Twenty-Eighth DoD Explosives Safety Seminar Held in Orlando, FL on 18-20 August 1998.</b>					
14. ABSTRACT <b>see report</b>					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>Same as Report (SAR)</b>	18. NUMBER OF PAGES <b>6</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

## **MAGNITUDE OF PILE NO. 1.**

The initial inspection of pile number one indicated the pile extended about 1.5 meters from the eroded shoreline, was 2.5 meters wide and had a maximum height of 1.5 meters. The size of UXO visible ranged from 37-mm to 8" projectiles and included some 40-mm grenades and a few bombs (approximately 250 lb.). The quantity of UXO's was estimated to be at least 300 items. The pile contained many UXO's that were unfuzed, with shipping plug or lifting eye in the fuze well. Some projectiles had engraved rotating bands, which indicated that the item had been fired and if fuzed, could be in an armed condition. Many of the UXO's were in an extremely deteriorated condition due to long term exposure in the brackish bay water and weathering, and as such, nearly all of the identification markings were no longer visible.

The first course of action taken was to install Jersey barriers into the shallow water, approximately 50 feet in front of two shoreline piles, to control any further shoreline erosion. The shoreline had eroded away approximately 100 feet over the last 30-50 years.

## **REGULATORY REQUIREMENTS**

An Environmental Assessment (EA) was prepared for the removal action as required by the National Environment Policy Act (NEPA) with a finding of no significant impact and signed by the Deputy Installation Commander on 22 July 1996. A public notice was published in county newspapers.

A Work Site Safety and Health Plan for the removal action was prepared and approved for the operation at Abbey Point Shoreline Pile Number One.

## **WORK SITE PROCEDURES, REMOVAL AND DEMOLITION ACTIONS**

The work consisted of : moving in support equipment; emplacement of personnel bombproof for cover during detonation and a bombproof for holding explosive shaped/demolition charges; inspection and determination of handling MMRI; movement or non-movement of MMRI; subjecting MMRI to on-site thermal treatment (shaped/demolition charge); clean-up of scrap ordnance/fragments (free of explosive or other residue) and inert filler (wax) for turn-in to Defense Reutilization and Marketing Office (DRMO) in accordance with latest guidance/regulation; and site restoration.

The removal action was limited to only visible MMRI within 15 feet and/or the low water mark surrounding Pile No. 1.

Site preparation required TEU EOD to conduct magnetometer sweeps for UXO avoidance at bombproof sites, demolition ground, and shoreline access routes. Separation distance between shoreline operations bombproofs, and demolition ground was based on a Maximum Credible Event (MCE) of a detonation of a single 8 inch projectile with 35 lb. of explosive. The distance used was based on calculations from TM 5-855-1 computer program (CONWEP) for fragment penetration and blast effects of a 8 inch, M106, projectile.

Removal action procedures required TEU to:

- Contact (maintain contact) with the on-site Emergency Incident Control Officer (EICO) and the Range Control Tower Operator prior to start of removal action until action was completed for the day.

- Work the pile from the top and sides to prevent rolling or tumbling of ordnance.

- Inspect and determine methodology for handling, moving or not moving MMRI from the pile based on, but not limited to: the condition of the UXOs, i.e. visual evidence whether the ordnance had been fired, unfuzed, fuzed (unarmed, armed), inert, high explosive (HE), or chemical (solid, liquid filled). Every method available was used to aid in identification (experience, manual, PINS).

- Determine MMRI that are safe to pick up and carry away (PUCA).

- Use crane (25 tons) to lift heavy PUCA from pile.

Stop operations and notify the EICO and Tower Operator when an unidentifiable, unmoveable, unstable UXO or chemical filled UXO is found.

Place all PUCA in wooden bins and remove bins by material handling equipment (MHE) off the shoreline to a staging area.

Operations continued until entire pile was removed.

Demolition (thermal treatment) procedures required ATC to:

Move wooden bins with PUCA from the staging area to the demolition area by MHE.

Remove PUCA and segregate MMRI by size and type and place on pallets.

Obtain a firing clearance from the Range Control Tower Operator (maintain contact) to begin thermal treatment (TEU and ATC work operations not performed simultaneous).

Move PUCA MMRI into demolition ground, position shaped charge, install safety fuze, retire to cover and detonate charge.

If this fails to destroy the PUCA item or some filler remains, additional C-4 explosive is used.

Place scrap metal in wood bins and remaining residue (wax) in 55 gallon plastic drums.

Move wooden bins and drums by MHE to holding area to await certification and disposition to DRMO.

## RESULTS

All work was accomplished at pile number one during the period 05 Sep. 97 through 28 Mar. 98. TEU removal operation required 11 days. ATC work required 49 days (26 days -demilitarization, 23 days to clean up of scrap metal and residue). All MMRI visible on the surface and out to the low water mark surrounding Pile No. 1 were removed (no sub-surface recovery was permitted).

A total of 693 MMRI were demilitarized (original estimate 300).

Table 1 shows the total MMRI demilitarized by TEU. These were blown on the beach with a C-4 block.

Table 2 list by date and caliber total MMRI demilitarized by ATC. As you can see about 75% of the MMRI demilitarized were large caliber (155-mm, 165-mm, 175-mm, and 8 inch). The 48 20-mm were all in an ammunition box and blown as one item with 3 pounds of C-4. The Livens (7.62 inch) was a World War I vintage chemical type projectile. One of the projectiles had been cracked open, and the other was intact except for the fuze. This projectile was of concern if it contained phosgene (CG). TEU overpacked the projectile and brought in their Portable Isotopic Neutron Spectroscopy System (PINS) and subjected the projectile to 3000 live seconds of counting. The results came back from the Idaho National Engineering and Environmental Lab (INEEL) as water filled. This finding, along with two other projectiles (155-mm and 175-mm), PINS will be discussed further in Table 3.

Table 3 shows the number of rounds by caliber and filler type demilitarized by ATC and TEU. The right side of the Table shows the number of rounds with HE, WP, and live burster which totals 61. In other words, 91% of the MMRI removed was inert.

The Livens listed with the live burster is the same projectile which had been PINS as water filled. The water fill, small amount of explosives (66 grams), and the number of seconds counting probably had something to do with the lack of detection of the live burster. However, the most important factor here was that the projectile contained no phosgene.

The results of two other projectiles PINS by TEU came from INEEL as the 155-mm filled with WP and 175-mm filled with HE. The detonation of each by ATC revealed that the 155-mm was WP filled; however, the 175-mm was wax filled. Both projectiles had been subjected to 3000 live seconds with intermediate spectra stored at shorter count times. I will not speculate as to why the results "exhibited strong nitrogen peaks".

A total of approximately 1600 pounds of explosives (mostly C-4) was used to demilitarize the 687 projectiles. The size of the demilitarization charges were 9.6 oz., 1.25 pounds and 3 pounds (C-4) linear

shaped charge; 2 oz. jet tapper; 0.25 pound, and 0.75 pound blocks; and MKI (0.75 pound) shaped charge. The use of the linear shaped charge required some experimenting with at first to establish a workable technique. The first charge generally was the 3 pound linear shaped charge follow by the 1.25 pound C-4 block to remove the wax filler. Approximately 150 projectiles required the second shot.

The scrap metal from the thermal treatment filled 21 wooden boxes (4'x4'x3') for an estimated total weight of 84,000 pounds. The wax filled 13 drums (55 gallon) for a total weight of 5,780 pounds. Pending inspection, certification, and new regulations/guidance, all scrap metal will be disposed of through the Defense Reutilization and Marketing Office (DRMO). A Toxic Characteristics Leaching Procedure (TCP) was done on the wax and the wax was not considered hazardous waste. The wax was sent to the Chemical Waste Management, Model City, New York, and placed in a landfill.

The shoreline site was deactivated by placing a thick cover (10 feet) of No. 1 stone to prevent possible sub-surface MMRI from surfacing. The Jersey barriers were removed.

Crew size on-site were small. TEU had 3 or 4 members, 5 when operating crane to lift PUCA MMRI. ATC had 4 members.

### **CONCLUSIONS**

All operations were performed safely and without incident or accident with trained and qualified EOD technicians. This proves that "Proven Technology" i.e. manual effort still is the most practical way to conduct certain difficult tasks in a safe and efficient manner. This work gave first hand "real world" experience to the workers in remediation action of removal of UXO's by the most basic means.

Periodic shoreline inspection at the former Pile No. 1 site may be required to determine any possible MMRI are surfacing due to wave action and erosion.

### **FUTURE ACTION**

Support for the removal action of MMRI from the other six remaining shoreline piles is being arranged with the U. S. Navy EOD Mobile Unit Two, Dahlgren, Va. The Navy has the responsibility for removal of UXO's from off-shore to the on-shore high water. The Aberdeen Test Center will fund this Navy support.

The Work Site Safety and Health Plan has been prepared to the removal action, thermal treatment, and clean-up. This will be a joint operation (U. S. Navy EOD Mobile Unit Two and the U. S. Army Aberdeen Test Center).

No time estimate can be given for completion of these piles. The number of MMRI expected to be removed from the six piles is probably twice the number of what was removed from Pile No. 1.



# **Aberdeen Proving Ground Maryland**



**Abbey Point Field**